EXPERIMENT K-002

RESULTS OF HISTOLOGICAL EXAMINATION OF INGUINAL LYMPH NODES

SUPPLEMENTARY REPORT by Lisbeth M. Kraft

NASA Ames Research Center

Moffett Field, California 94035

Materials and Methods

Inguinal lymph nodes of 18 rats from Experiment K-002 that flew on board Cosmos 782 in 1975 were received in neutral 10% formalin. They were processed for paraffin embedding, and sections 6 μm thick were stained with hematoxylin and eosin, pyronin-methyl green, and picrofuchsin. Six of the rats were of the vivarium control group, 6 were of the synchronous control and 6 of the flight group.

Results

Lymph nodes of the vivarium control group show only normal variations of structure. Both nodular and diffuse arrangement of the parenchyma can be found, which is further reflected in the fibrous framework as seen in picrofuchsin preparations. Active germinal centers with pyronin positive cells are found in some of the nodes of 3 rats of this group. Mitoses are occasionally observed. Necrotic cells and debris within the centers are normal in amount. Only rarely is a necrotic cell seen elsewhere. The sinuses contain the cells usually seen: lymphocytes, histiocytes, plasma cells, and some erythrocytes.

Essentially the same picture is seen in the synchronous control group, except that occasional foci of necrotic cells can be found in the parenchyma. These are composed at most of only 2 or 3 cells each. Most of the cells seem to be at about the same stage of degeneration. There is no evidence of phagocytosis.

The most outstanding differences between the flight and ground control groups are: 1) marked and widespread depletion of lymphocytes resulting in much larger pale zones than in controls, and 2) the occurrence of numerous foci of pyknotic and necrotic cells together with variable amounts of dust-like debris. The foci are not confined to germinal centers. Rather, they are found throughout the parenchyma as seen in Figs. 1 and 2. Contrary to the situation in the ground control rats (Figs. 3 and 4), active phagocytosis of necrotic cell fragments and debris by fixed macrophages is taking place in the penetrating sinuses of lymph nodes of all flight animals. Further, in some medullary sinuses necrotic cells are also being engulfed by histiocytes, although this is seen far less frequently.

Few necrotic cells can be seen in the subcapsular sinus, indicating that those within the node may be arising there.

Cells with pyronin positive cytoplasm appear to be as numerous in flight animals' nodes as in those of controls.

Comment

The rare necrotic cell seen in the parenchyma of the nodes in the vivarium control animals is regarded as normal. The slight increase of such cells observed in the synchronous controls can be considered a

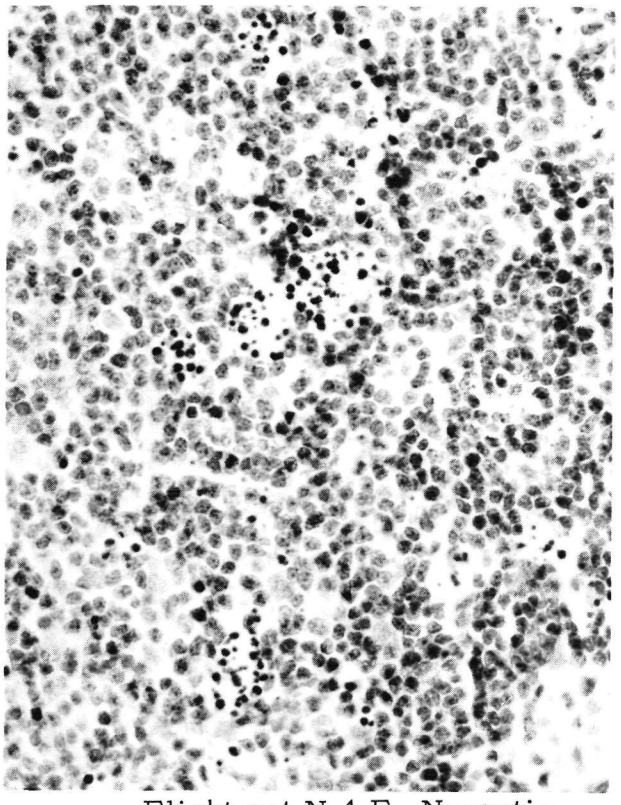

Fig. 1 Flight rat N 4 F. Necrotic cells and debris in a pale zone of the node. Much of the debris appears to be within penetrating sinuses. x440.

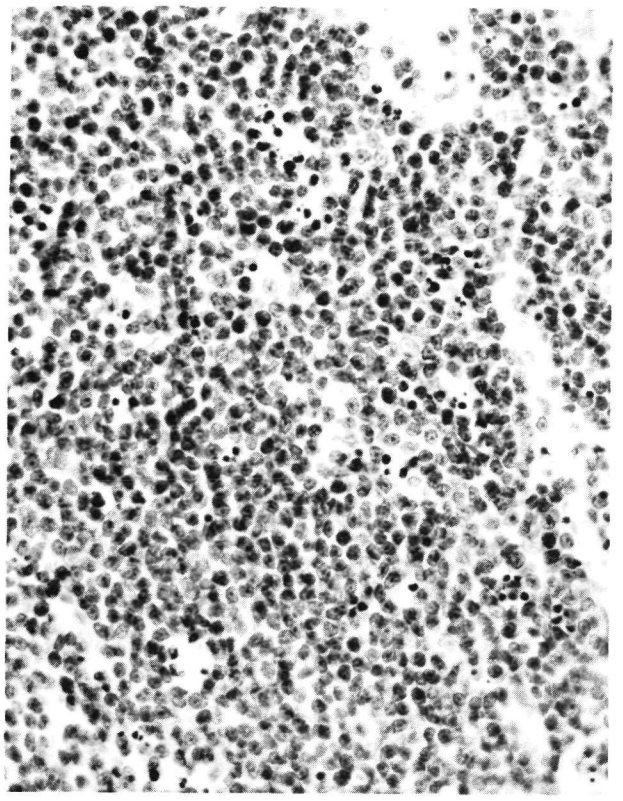

Fig. 2 Flight rat N 4 F. Necrotic cells and debris in a more densely sellular region than in Fig. 1. Scattered individual necrotic cells as well as cell groups are present. x440.

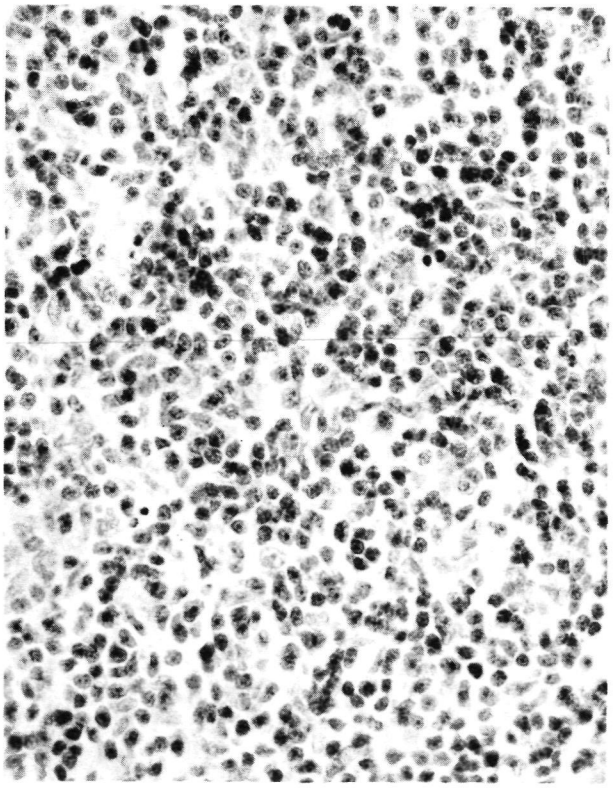

Fig. 3 Synchronous control rat N 3 SC. Pale region of node showing three obvious necrotic cells. X440.

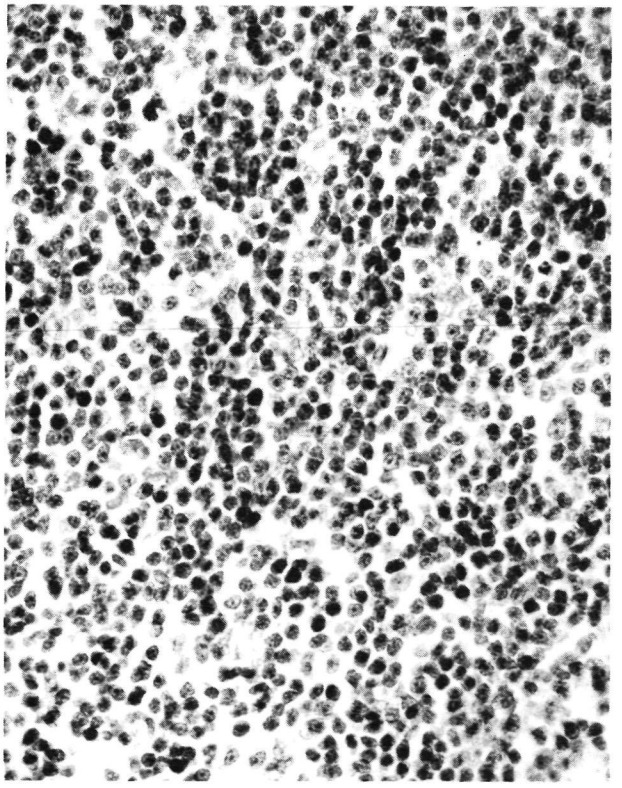

Fig. 4 Vivarium control rat N 5 C. Coronal zone with one necrotic cell. X440.

response to the stress of the simulated landing sequence to which this group had been subjected. The absence of phagocytosis supports this view.

The striking increase in the number of necrotic cells in all nodes of all flight animals, together with evidence of phagocytosis of some cellular debris, is thought to be due to the multitude of stressful conditions of prolonged flight. These would include both weightlessness and cosmic particle radiation, neither of which were experienced by the control groups. Other factors, both known and unknown, might also have played a role.

Precisely how the increased destruction of lymphoid cells fits into the results of the main K-002 experiment or with the increased destruction of erythrocytes shown in Experiment K-003 must remain an open question until further studies can be undertaken.